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Translations on Soviet Industrial Development

SOVIET FERROUS METALLURGY (24)

Introduction

This is a serial publication containing translations of selected articles on ferrous metallurgy in the Soviet Union. This report consists of translations on subjects listed in the table of contents below.

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1. The Utilization of Fuel in Metallurgy

By Z. F. Chukhanov

(Ogonek, Moscow, No 51, Dec 1961, p 17)

The Party Program states: "Electrification, which is the core of the construction of the economy of the communist society, plays a leading role in the development of all branches of the national economy, in the accomplishment of the entire contemporary progress." This requires the development of the new science placing power engineering in a preeminent rank in the development of all technological processes in any branch of industry -- the science of powertechnology.

We, power engineers, know well that nearly every existing technological process requires a considerable quantity of heat to obtain the finished product. In this connection, the heat provided is far more than is actually needed. Contemporary technology, speaking figuratively, behaves like a wastrel and spendthrift. Take this example: it is theoretically calculated that one-third of a ton of rated fuel is needed to produce a ton of steel. Actually, however, five to six times as much fuel is consumed for this purpose. Why?

The production of steel at present is very complicated. At the concentrator factory the ore is crushed and thereupon separated from gangue. The ore is obtained in pulverized form. Subsequently it is sintered, that is, baked in special furnaces into large black lumps which, in turn, are crushed and then charged into the blast furnace.

A considerable amount of heat energy is expended on the production of the sinter. A still more complicated path is traveled by coal before being transformed into coke.

Or take another example. Consider the finale of contemporary metallurgical production -- the rolling mill. The slab -- a chunk of incandescent metal -- is racing on the roller table, clanging and roaring. While passing in between the rolls it becomes reshaped into an H-beam, a

channel, or a rail. At the same time, the metal cools.

Now its initial temperature was of the order of 800 to 1,000 degrees Centigrade. If we consider the tremendous productivity of a modern rolling mill, it becomes clear that a colossal quantity of heat is thus wasted.

I cited only two examples taken at random from the entire present cycle of steel production. Obviously, contemporary metallurgy cannot be content with that modest one-third of a ton of rated fuel which, according to calculations, is needed to produce one ton of steel.

We can encounter similar "power gluttons" in nearly every field of modern technology.

This pertains primarily to the branches of industry whose development in the next 20 years will proceed at an especially rapid rate. I mean metallurgy, chemistry, and building materials.

It is known that gluttony does not end well. "Power gluttony" is especially detrimental to the national economy. It is fraught with economic ineffectiveness as well as with an excessive over-consumption of very scarce and expensive types of fuel whose worldwide reserves are relatively small, such as, for example, coking coals.

I believe that with the continuing rise in production all the principal and auxiliary technological processes will undergo extensive qualitative changes. Previously power, its consumption and its generation, played an auxiliary role in technological processes whereas now, speaking in the language of diplomacy, it should be an equal partner of technology, one which has signed a "joint power technological pact" with technology.

Then power will be saved and all the possibilities for obtaining the maximum amount of valuable products will be comprehensively utilized.

How do I conceive the future "energometallurgy"? A new technology and hence also new equipment will supplant the sintering furnaces, coke-oven batteries, and blast furnaces. This will save a gigantic amount of heat.

The blast furnace will be replaced by a special furnace or, as we shall term it, the "high-temperature flame." In contrast with the blast furnace, this flame will burn any fuel: coal, natural gas, liquid fuels, and even peat. Pulverized ore and, for example, ground coal will be blown into this furnace. In the flame there forms a gas reducing the iron in the ore. Thereupon this iron accumulates in molten form in the bottom part of the furnace. As for the gas itself which, incidentally,

has a very high temperature, it will be conveyed directly from the furnace to the furnaces of the boilers of the neighboring electric power station, where it will be burned to generate steam and electrical energy. As for slag -- the waste of metallurgical production -- it is utilized to obtain first-class cement clinker.

Thus, the energometallurgical combine will constitute an organically integrated whole consisting of an electric power station and a metallurgical plant. At this combine the fuel-burning electric power station with a capacity of, say, one million kilowatts, will be associated with a plant producing approximately two and one-half million tons of steel annually. Consequently, five energometallurgical combines of this kind, each with an electric power station with a capacity of two million kilowatts, will be able annually to provide the country with 60 to 70 billion kilowatt hours of electrical energy, 25 million tons of steel, and 15 million tons of cement clinker.

In this connection, the cost of metal will decline in half, and, what is especially important, the total capital investments in steel production will decline nearly as much. According to preliminary calculations alone, this will yield savings of more than 500 million rubles annually.

We do not have to search hard for examples.

Let us take Krasnodarskiy Kray. The reserves of the Kerch' Ore Deposit will be adequate for the future local energometallurgical combine. Krasnodar gas is an ideal fuel. Thus metal and current are assured. But this is not all. It is known that Kerch' ore contains a large amount of phosphorus. At the energometallurgical combine this phosphorus will serve to produce agricultural fertilizers. Natural gas will make it possible broadly to expand the output of synthetic rubber, "kapron" [Soviet nylon], etc. Thus, the powertechnological combine will provide literally everything: steel, current, tire casings, nylon jackets, agricultural fertilizers and cement. And all this can be created with a minimum of outlays, because energotechnology is by its very nature maximally economical.

But the importance of energometallurgy, and powertechnology in general, lies not only in this. By providing the premises for new production techniques, it opens the prospects for changing the geography of industry. Considering that the widespread fine and relatively iron-poor ores are suitable for energometallurgy, the new method will serve to establish metallurgical industry in any region of the country. The fuel would be any coal, natural gas, liquid fuel, and even milled peat.

Naturally, this will change the national fuel balance. The role of

coals, petroleum, gas, and milled peat, will increase. And the other types of fuel, such as the products of subterranean gasification, lump peat, various underground-mined brown coals, and curtain petroleum deposits, will no longer be developed, for they will be economically unjustified.

The Party Program states precisely the following: "The less effective types of fuel and power and raw and other materials will be increasingly displaced by highly effective ones, in which connection their utilization will be much more comprehensive."

The introduction of powertechnology in all fields of industry will mobilize gigantic potential and yield tremendous savings to the country.

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2. A "Help Wanted" Advertisement

(Stroitel'naya Gazeta [Construction Gazette], Moscow, 14 Jan 62, p 4)

Kmarudstroy [Kursk Magnetic Anomaly Ore Construction Trust], Belogorodskiy Sovnarkhoz has employment opportunities in the City of Gubkin

For: Director of a Combine of Production Enterprises; Chief of Reinforced Concrete Shop; Chief of Large Wall Blocks Shop; Chief of Lumbering Shop; Chiefs of Construction Administrations; Chiefs of Planning Divisions of Construction Administrations; Chiefs of PTO's [Production and Technical Sections] of Construction Administrations; Chief Bookkeepers of Construction Administrations; Chief Mechanics of Construction Administrations. Pay based on wage categories. Pay for underground workers in accordance with Article 82 of the KZOT [Labor Law Code]. Housing is provided.

Address inquiries to: Belgorodskaya Oblast, Gubkin, "Kmarudstroy" Trust.

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3. Establish More Quickly the New Ore Base for the Metallurgy of the Urals!

By P. Kazakov

(Ekonomicheskaya Gazeta [Economic Gazette], Moscow, 15 Jan 62)

The Kachkanar Mining and Concentrating Combine is being established during the present Seven-Year Plan. This is one of 476 especially important projects. Here, not far from Nizhnyy Tagil, lies the biggest "storehouse" of iron ore in the Urals. Its reserves are assessed at eight billion tons.

The ores of Kachkanar occur essentially on the surface. They are relatively low-grade -- they contain on the average 16 to 17 percent iron. Their industrial exploitation is economically expedient in view of the large scale of open-strip mining possible, as well as the use of the most up-to-date concentrating equipment and the comprehensive utilization of the raw material.

The concentration of these ores is scheduled to be based on the magnetic separation method. The concentrates to be received by the metallurgists will contain 63 to 64 percent iron and two to three percent silicon dioxide.

The production cost of pig iron will be favorably affected by the circumstance that the slag forming during the smelting of ore will contain a great deal of valuable vanadium.

The combine is being built in two sections. The first section is designed to extract 33 million tons of ore annually in the Gusevorskiy Pit. Six million tons of sinter and pellets will be annually sent to metallurgical plants.

After the construction of the second section is completed and raw material also will be mined from the Kachkanar Mountain, the enterprise will yield 60 million tons of raw ore annually. Nowhere else in the world is the development of low-grade ores practiced on such a colossal and economically expedient scale.

Once the combine works at full capacity, the shipments of iron ore from other regions to the metallurgical enterprises of the Northern and Central Urals will be discontinued.

The first builders arrived in the region of the Kachkanar Mountain in the spring of 1957. Now the construction site has spread over some 20 kilometers.

This is the decisive year. The schedule provides for putting into

operation the so-called minimal complex of the ore-mining giant (approximately one-fourth of capacity of the first stage). It is designed to extract seven and one-half million tons of raw ore and produce one and one-half million tons of concentrate annually.

There exists every opportunity for solving this task, and it should be solved!

The collective of 13,000 builders of the Kachkanar Combine has reached definite seccesses. A town of more than 13,000 inhabitants has mushroomed at the foot of the Kachkanar Mountain. The principal buildings have been erected. The dam structures of the open-water reservoir and slurry reservoir as well as the electric railroad are being built on an extensive scale. Nevertheless, many difficulties and shortcomings are present on the site.

It is these that are described in the report published below.

Both Joys and Sorrows

Nothing like this had ever occurred here before. The taiga was humming. Sixteen crawler-tread tractors were pulling a gigantic sledge on which stood a frost-covered electric locomotive.

The extraordinary procession descended into the valley of the Vyi River, passed the guidepost of the pump station, and, over a temporary path, hurried toward the Gusevyye Mountains. Upon arrival there, at the main pit, the locomotive was transferred from the sledge onto rails. Current was turned on. Dumpcars were driven up and attached. An excavator, without hurrying, raised its bucket... And thus occurred the recent opening of the pit from which the combine extracts its ore. By the same token, the foundation has been laid for extensive overburden-stripping operations and for preperations to provide ore to the concentrating factory.

The participants in this event greeted each other with other good news: yet another stage in the establishment of the giant enterprise was nearing its end. A majority of the builders had arrived at the site of this national project as Komsomol volunteers. They knew that tremendous difficulties were awaiting them in the remote taiga. But these volunteers surmounted them courageously: they felled trees, built houses, laid roads, and established the production base.

Kachkanar has raised more than one thousand daring, self-sacrificing builders. In bone-chilling frost they repaired a high-tension line which was damaged by a hurricane, extricated equipment which became stuck

in the swamps, and remained for days on end inside a 30 meter-deep foundation pit.

Now, looking at the excavator which was filling a dumpcar with ore, the builders realized that much work was yet awaiting them. They were aware that the opening of the open-strip pit, although a joyous and solemn event, was nevertheless symbolic in itself.

And the director of the combine, N. Yefremovtsev, also knew that from the moment when he had cut the ribbon stretched across the railroad track to the moment of the opening of the enterprise itself there still remains "an enormously long distance." This was eloquently attested by the buildings of the concentrating factory, looming from afar, which are still far from ready to receive ore. And, moreover, the railroad itself still was not built yet....

The year has come to an end but progress on the site as a whole has not been too good. Each contractor and subcontractor organization without exception had fulfilled barely half the plan, and each advanced a different explanation for its failure. Some referred to internal causes, and others, to external. But one way or another the effect of these causes was identically negative.

The prime contractor -- the "Kachkanarrudstroy" [Kachkanar Ore Mine Construction Trust] -- is relatively young. Considering this, the Sverdlovskiy Sovnarkhoz a year ago decided to help it and improve the situation by assigning specific parts of the project to such large and experienced construction trusts as the "Tagilstroy," "Basstroy," and "Serovstal'stroy."

The idea was right. But it was fulfilled in the wrong way. It was believed that the new contractors would use for the benefit of Kachkanar their own fairly highly developed production bases. But this did not so happen. Upon being awarded the contracts, these trusts dispatched to Kachkanar only the collectives of individual sectors and administrations. And so the "Kachkanarrudstroy" had no choice but to share with them its own housing and, most important, the output of its own, as yet not completed, production base.

And then there also occurred the bottleneck as regards deliveries of reinforcement. The sovnarkhoz sent it in literally homeopathic doses although officially Kachkanar was assigned enough metal. Thus the operations of the reinforcement shop at the site even had to be discontinued. "Scavengers" wandered all over the site in search of defective prefabricates from which they would remove the concrete so as to reclaim the reinforcement. When the chief engineer of the combine project, B. Sherman, arrived from Sverdlovsk, the first question he was asked was:

"Show us, please, where is it possible to work without reinforcement?"

When, however, at the end of November, reinforcement was received, the contractors proved not ready to launch the operations: there was not enough concrete and mortar.

The contractors began stubbornly to vie for every cubic meter of these materials. The chief of the construction administration of the "Tagilstroy," K. Postylyakov decided to build his own small concrete plant as well as a small woodworking plant. The other construction and installation organizations, of which there are at least 15 on the site, also decided to build their own little plants. More than one hundred tons of metal, more than one thousand cubic meters of concrete were reassigned on the sly to these little plants. But the greatest flaw was that considerable manpower and financial resources thus were diverted from direct work on the objects of the combine.

All these losses could have been avoided if the Sovnarkhoz had assigned to direct the whole of this big and important project a man provided with the necessary powers and rights, who would concentrate in his hands the material resources of all four contractors. Such a manager (his role is currently fulfilled by the head of the "Kachkanarrudstroy," F. Karlyukov) would not have to try to influence these four equal partners by letters sent them through...the Sovnarkhoz. However, the officials in Sverdlovsk merely confined themselves to issuing yet another directive: "The heads of trusts are under the obligation of... fulfilling all operative instructions of the head of the 'Kachkanarrudstroy' concerning the organization of construction..."

One would like to ask: how could Comrade Karlyukov "place the heads of trusts under the obligation" when they are working many tens of kilometers away from the construction site?

The construction is also complicated by the circumstance that the "Kachkanarrudstroy" Trust has in the course of four years, like a ship overgrown with barnacles, become overgrown with a miltiplicity of small construction sheds and other similar structures. They were built as temporary structures but, considering that the construction operations on the site have been extended, these structures became unfit and had to be repaired or rebuilt. Otherwise the management of the combine refused to finance them.

The total volume of incompleted construction operations and objects as regards this project is 50 million rubles! Even the Kachkanar--Aziatskaya railroad spur, under construction since 1958, still is not perfect.

In a nutshell, five years after the beginning of the construction not one object has yet been released for regular operation.

It is under such conditions that the builders of Kachkanar welcomed the new year 1962.

Problems Which Need Not Have Existed...

The target date for activating the minimal one-fourth of the first section of the combine, with a capacity of seven and one-half million tons of ore annually, has been postponed until 1962. The builders and installers face implementing a tremendous volume of operations.

So far several screens have been installed in the fine- and medium-crushing building, and the first receiving bin has been assembled there for storing the comminuted ore before it proceeds to the concentration building. The installation of the hundred-ton overhead crane, which will serve to assemble heavy crushers, has been completed. Soon the assembling of feeder conveyors will begin.

The installation of the starting sections is being consolidated. The builders as well as the young personnel of concentration workers being formed at this new Ural industrial center are most of all agitated by the situation as regards the coarse crushing building. It extends to a depth of 50 meters inside the rock, and its total height is twice as great. But at present this building, whose erection was entrusted to the "Tagilstroy" Trust still has not risen to its full height, having risen to only slightly more than 20 meters. Instead of 80,000 cubic meters of concrete less than 20,000 have actually been laid.

The sector chief, O. Khaydukov, declared: "We should lay at least 12,000 or 13,000 cubic meters of concrete per month."

Actually concrete is being laid at irregular intervals: 30 to 40 cubic meters per day. The local belief is that once the "Tagilstroy" will open its own [concrete] plant nearby, it will overtake its neighbors, who are building the medium-crushing building. This is possible. The heads of this trust should devote the greatest attention to this most important object in Kachkanar by utilizing their substantial production base in Nizhnyy Tagil to fulfill rapidly all needs of the Kachkanar Project.

The second object scheduled for activation where the situation is also unfavorable is the hydraulic engineering structures: the Vyi River Dam and the dam of the slurry reservoir. These should be built before the springtime floods. Without water the combine cannot be put into oper-

ation: after all the concentration building alone will consume more than eight cubic meters of water per second.

The complexity of building the dams is increased by the need to include a large-capacity pump station. When the water reservoir is filled, the main structures lying 40 meters deep in the rocky soil, are subject to inundation. Therefore, the pump station will first have to be built. However, the "Kachkanarrudstroy" Trust clearly is not capable of accomplishing this prior to the spring floods.

What to do? The comrades from the "Uralspetsstroy" insist that preparations for the floods should be made, but the heads of the "Kachkanarrudstroy" object, fearing that the station would be incompletely built and fail its purpose. Discussions and debates go on endlessly.

The chief engineer of the combine, S. Myasnik, having listened enough to specialists of every kind, declared:

"It seems that the target dates for putting into operation the first part of the first section of the combine will be drowned in this discussion about the drowning of the pump station! "

It is now several months since the "melee" about the method of filling the foundation pit for the coarse-crushing building had started. The "Uralpromstroyproyekt" Institute proposed a method of its own. But the specialists from the "Giproruda" Institute believe that this proposal will raise the construction cost of the building by 350,000 rubles. The "Uralgiproruda" offered a counter-proposal. The dispute was also joined by the "Proyektgidromekhanizatsiya" Institute. Ten different proposals have already been advanced, and meanwhile the work has been suspended.

This is a little fact, but one very characteristic of the situation in Kachkanar.

Another circumstance also is alarming: the neglect displayed toward objects vitally important to the performance of the combine -- a neglect rare in our time.

The endless "modifications," "refinements," and "cost cuts" etc., as applied to the minimal starting section, have led to a situation in which the construction of the central thermoelectric powerhouse in Kachkanar has been postponed from year to year. To fill this gap, builders had to construct more than 20 small and unprofitable steam heat plants, each costing 20,000 to 50,000 rubles, and each with a personnel of 30 to 40. Thus a sizable group of builders was diverted from productive labor.

The project of the combine provides for a machine repair plant, but

this plant was not included in the minimal starting complex. And yet on the site there operates a large number of mechanisms: various types of cranes, excavators, hundreds of bulldozers, about 1,000 motor vehicles. Essentially there is no base in situ for their repair. To solve this problem, the various organizations built their own repair shops. The "Uralspetsstroy" expended about 80,000 rubles on its shop, and the "Vostokmetallurgmontazh" and "Uralstal'konstruktsiya," twice as much....And yet it would have been so much more convenient to build that machine repair plant.

Equipment is arriving for the minimal starting complex: transformers, crushers, grinding mills, feeders, conveyor belts, pumps, boilers... Some of them have been installed, but the majority, valued at altogether eight million rubles, is idling in outdoor and indoor storage while waiting for assembling space.

The builders attempt to do all in their power to observe the target dates for the minimal starting complex.

The secretary of the local Party unit, delegate to the 22nd Party Congress, A. Serchenko, declared: "We shall not lag; we'll do our part. If only the planning agencies and the Sovnarkhoz will not fail us."

One day after this conversation I met the Deputy Chairman of the Sverdlovskiy Sovnarkhoz, in charge of construction matters, M. Shil'dkrot. He said that the starting complex of the combine is on the point of receiving the final approval and that "the Sovnarkhoz shall not fail the builders": instead of four "generals" -- general [prime] contractors, there will be only two.....

"It is merely necessary that the Supreme Sovnarkhoz pays us more attention...."

I transmitted to comrades at the Supreme Sovnarkhoz M. Shil'dkrot's wish, and his complaints about the storage of metal. And here the unexpected happened. V. Bagirov, co-worker of the Administration of Capital Construction, Supreme Sovnarkhoz, showed me a telegram from M. Shil'dkrot stating: "This is to advise that we have sufficient supplies of rolled stock for 1961." This was complemented by data on the reception and consumption of metal from which it ensued that Kachkanar was being rather satisfactorily supplied with metal.

So then what happened to this metal? There can be only one reply: the Sovnarkhoz assigned it elsewhere. Being aware that the Kachkanar Combine has priority in the allotment of materials and funds the Sovnarkhoz utilized it as its reserve stockpile. Seven thousand tons of steel and water-supply pipe were allotted and sent to Kachkanar, but they are

not there: they ended up at other construction sites. The same pertains to reinforcement.

The Sovnarkhoz people complained about the shortage of cement in Kachkanar. This too is unjustified. The point is that in the Sverdlovskiy Economic Region the quality of inert materials is paid scant attention. Although many resolutions were adopted in support of providing finely crushed rock for important construction projects, these projects still continue to receive shipments of the wastes of metallurgical and other enterprises, coarse rocks. As a result, cement has to be overconsumed: instead of 320 kilograms per cubic meter of concrete, 350 kilograms are consumed.

These are but a few of the problems which the heads of the Sverdlovskiy Sovnarkhoz could not solve in situ and for which they claim that higher authorities are responsible. No, it is they themselves who should properly utilize the potential, and use allotted resources according to the purpose for which they were allotted.

On the same days when Comrade Shil'dkrot asserted that he "will not fail" the builders, he was concerned less with compiling a schedule for the construction of the combine than with drafting a letter requesting the postponement of the activation of the minimal starting complex to 1963. Such a letter specifically had been received by the Supreme Sovnarkhoz at the time.

What then is the result? For about five years now the State has been investing funds in the construction of the huge mining and concentrating combine, while the Sovnarkhoz, having failed to mobilize its potential and concentrate resources, is now asking for another postponement.

It is a matter of honor to the Ural workers to achieve the unconditional activation this year of the starting complex of the combine and later on of the entire first section of the combine.

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4. The Scientific Basis of Metallurgy

By Yu. Grdina

(Ekonomicheskaya Gazeta, Moscow, 1 Jan 62, p 11-12)

...A land of Great Promise

West Siberia is being called upon to play a leading role in the further development of our country's metallurgy. As soon as within the next few years the Kuznetsk Metallurgical Combine should be modernized and the West Siberian and Barnaul plants as well as the Tashkent Combine should be built.

Later on, the task of sharply increasing the output of metal will undoubtedly stimulate not only new projects but also their embodiment in the form of new metallurgical plants and combines. In the not distant future the region of West Siberia will account for a major part of the total output of ferrous metals in the country. The premise for this is the availability of vast and still imcompletely explored reserves of iron ores and coals as well as extensive energy resources which are being harnessed in the course of the construction of an entire system of super-high-capacity hydro- and thermo-electric power stations. In addition to all this, the machine-building and construction industry of the economic regions of West Siberia are becoming major metal consumers.

We are on the eve of large-scale scientific research projects regarding primarily the investigation and evaluation of ores and development of ore concentrating and sintering techniques. It is important to consider in practice the averaging of ores and the drafting of a general operational plan of development of ore deposits assuring an optimal composition of the ore consumed by all plants during various periods of their operation.

Of great importance is the task of utilizing the secondary and dispersed elements present in the ores. This concerns primarily zinc, which is present in a majority of West Siberian ores, followed by cobalt, bismuth, arsenic, and certain other rare elements.

The urgent tasks also include the problem of coking coals, and especially the expansion of the variety of coking coals. The development of new coking techniques, research in spherical briquets, and the resumption research in iron and coke are among the most pressing problems of the metallurgy of Siberia.

Another major trend in the solution of the metallurgical problems proper is the work on the converter production of conventional and low-carbon metal. This method of steel production is progressive and will be widely used. The first shops will probably contain 120-ton converters, and later their capacity will increase to 200 to 250 tons. Neither in our country nor abroad has experience yet been gained in using oxygen in installations of such a size. Naturally, the mastering of new technology will involve quite a few new and complicated problems. The specific

features of the chemical composition of various types of iron, methods of feeding oxygen, the durability of equipment, and the properties of the metal obtained will have to be carefully studied. It is necessary, for example, to keep in mind that the metal will be used mainly in Siberia itself, that is, under the conditions of the low temperatures of the Siberian winter, when the cold brittleness of steel can especially manifest itself.

Important technical and economic problems are being aroused by the rise in the generation of electrical energy in Siberia. As noted by N.S. Khrushchev at the 22nd Party Congress, "In East Siberia, in addition to completing the construction of the Bratskaya and Kradnoyarskaya GESes [Hydroelectric Power Stations], several other hydroelectric power stations of the same capacity will be built by 1980, namely, the Sayanskaya, Ust'-Ilimskaya, Boguchanskaya, Yeniseyskaya, Osinovskaya, and Nizhne-Tungusskaya GESes. Each will have a capacity of more than four million kilowatts."

In addition, in the same area, on the basis of the coals of the Kansk-Achinsk Basin, two groups of highly economical super-high-capacity thermoelectric power stations will be established: in the Krasnoyarsk - Itatsko-Bogotol'skaya region, and in the Kansk--Tayshet-Irsha-Borodinskaya region, with a capacity of upward of three million kilowatts per power station.

New Grades of Steel -- New Principles of Production

Low-cost energy as well as extensive reserves of iron ores and nonferrous ores will provide the conditions for the development of electrometallurgy, for the production of special steels and alloys and ferroalloys as well as nonferrous metals and especially aluminum which consumes much power. Considering the specific features of Siberian raw materials, the organization of all this production requires the implementation of a large number of technical-economic studies and the development of new technological processes. New grades of steels and alloys with especially high properties will be mastered for new equipment. The development and mastering of these steels and alloys requires enormous scientific-research work.

Of special importance are the problems of the complex automation of metallurgical processes. There is no doubt that automation combined with a broad use of induction computers will be employed very widely in the design and construction of new plants. Extensive scientific-research work still has to be accomplished in this direction. Aside from the automation of equipment, where the problem is reduced mainly to developing electric circuits, the automation of the metallurgical process itself, the drafting of complex parameters determining the course of this process,

and the problems of measuring these parameters and finding the necessary mathematical relationships are still in a rudimentary stage. Mechanics, power engineers, physicists, chemists, electronics engineers, and mathematicians will have to labor hard to solve these problems.

The use of oxygen, vacuum, and electronic automation has created every premise for a radical transformation of the process of steel production. All these means, initially developed to improve and perfect old metallurgical processes ultimately lead to the abandonment of these processes. It is now quite realistic to consider the idea that a continuous stream of pig iron flowing from a blast furnace or a mixer could be treated with oxygen to eliminate excess carbon and silicon. Clearly, the treatment of steel with synthetic slag and the deep killing and degassing of steel in a vacuum will also become continuous processes of the same kind. After these operations the steel will proceed into devices for continuous teeming, from which it will issue in the form of billets.

The development and introduction of such a method of steel production would alter radically the entire appearance of the modern metallurgical plant. Only the blast furnaces and section mills would remain, that is, the entire intermediate process would be continuous. It should be noted that such a form simplifies considerably the problems of the automation of metallurgical production. The form itself of the continuous-action process causes metallurgical production to be similar to continuous-action chemical production. This is perfectly legitimate considering that metallurgy both as a science and as a branch of industry constitutes high-temperature chemistry.

In its present stage, ferrous metallurgy has all the conditions for the appearance of new processes. Their development has become the most important and pressing task. Needless to say, the introduction of the continuous-action process will considerably reduce construction cost, cut production cost, and improve production quality, because it is the processes of smelting and, especially, teeming that are the principal source of defects and low quality of steel production.

A more remote prospect, but one which is already seriously investigated in the United States, is the high-temperature treatment of any ore. At temperatures of more than 2,500 degrees Centigrade most metal oxides are observed to dissociate. Upon subjection to such a heating the ore is reduced to metallic state. The final product is a melt of the metals making up the ore. The more easily fusible constituents of the ore are separately evaporated and condensed. Such a process requires a very fine grinding of the raw material as well as high-temperature heating. At a semi-industrial installation in the United States the heating is accomplished by passing a fine powder through powerful voltaic arcs. But this is not the only solution. It is also possible to employ the so-called

cyclone smelting, which in our country is used in nonferrous metallurgy. The work on these problems will undoubtedly lead to considerable progress in the physico-chemistry of metallurgical processes. After all, these hugely important problems cannot be solved without elaborating their theoretical aspects.

In the Interest of Purposive Research

In his speech at the 22nd Party Congress the President of the Academy of Sciences USSR M. Keldysh expressed his opinion that it is necessary to begin organizing unified scientific establishments in the economic regions and Union republics, to provide them with up-to-date equipment and to staff them with cadres capable of making new contributions to science. Comrade N. S. Khrushchev in his concluding speech supported this idea.

Currently, purposive research in the field of metallography and metal physics acquires special importance. In connection with the growth in the scale of production as well as the acceleration of processes, for example in the rolling of metals, there arise problems whose practical solution involves tremendous difficulties. For example, the problem of the heat treatment of rails has not been satisfactorily solved anywhere in the world. After many years of research in our country we have started the design and construction shops for the heat treatment of rails in rail-rolling plants. The mastering of this process will cause the domestic rail industry to lead the entire world in quality. But before the heat treatment of rails will win its "place in the sun," much hard work will yet have to be accomplished in the scientific research institutes as well as in the plants.

The heat treatment of reinforcement is absolutely necessary. This is clear to everyone. For example, instances of cold-brittle rupture of prestressed reinforcement inside concrete can be observed. However, in view of the speeds of rolling, which in modern rolling mills reach 20 meters per second, the heat treatment of reinforcement is extraordinarily complicated. The old methods of accumulating a bundle of reinforcement rods and subjecting it to group heat treatment are not applicable at all, because they do not assure the stability of properties as well as the necessary straightness of the rods. Slowly performing continuous-action installations require the construction of shops with a surface area measured in square kilometers. Thus, fundamentally new solutions based on a broad use of high-frequency heating currents, etc., have to be sought for.

In the field of theoretical metallography and physical metallurgy the principal task is to obtain metals with the maximum theoretical

strength. This means a strength of thousands of kilograms per square millimeter, whereas the metals used in our practice have a strength of not more than 300 kilograms per square millimeter and normally even several times less. Moreover, the development of new equipment requires metals with a high heat resistance and high magnetic and semiconductor properties.

There can be only one conclusion: the quantitative and qualitative development of metallurgical production can be accomplished only on the basis of the development of metal science and a broad expansion of the entire front of the varied branches of science.

The scientists working in this field have far from taken every step necessary to accomplish this task. Fulfilling the decisions of the 22nd Party Congress, we should expand considerably the scope of research and tackle more boldly the development of the fundamental problems in the field of the production and properties of metals.

The regions of Siberia are considerably lagging behind in this work, although in the future they will have to produce tens of millions of tons of steel. The Siberian Branch of the Academy of Sciences USSR in Novosibirsk does not take up problems relating to metallurgy. Its structure does not even include an appropriate institute. Likewise, there are no scientific research institutes of metallurgy in Siberia and the Far East, except the pedagogical Siberian Metallurgical Institute in the Kuznetsk Basin as well as the pedagogical Institute of Nonferrous Metallurgy in Irkutsk. These institutes, of course, conduct some research, are establishing problem laboratories, and maintain certain ties with industry and the sovnarkhozes. But they lack appropriate cadres of researchers as well as special laboratories and equipment, and they cannot encompass the complex whole of the problem arising in connection with the development of the new metallurgical region.

In this connection, research work should precede design and construction, otherwise designs will be based on obsolete solutions and the individual units and parts of new plants will prove technologically backward. Such a warning was given at the 22nd Party Congress by Comrade N. S. Khrushchev.

Siberia is in an especially difficult situation. The imbalance which has arisen there should be urgently rectified. This is additionally necessary because Siberia cannot count on any considerable and broad assistance from the scientists of the Central and Southern USSR as well as the Urals. They are burdened with the solution of tasks posed by their own economic regions, and it would be well if they would succeed in fulfilling all that is being demanded of them.

In West Siberia there is a definite need for a large complex scientific research institute of metals. The site for this institute could be the city of Novokuznetsk, where are located two huge metallurgical enterprises -- the Kuznetsk and West Siberian plants, and where is concentrated a large number of design institutes. In addition, this city contains a huge aluminum plant and a ferroalloys plant.

The Siberian Institute of Metals could be established under the pedagogical Siberian Metallurgical Institute and the Kuznetsk Metallurgical Combine. This would facilitate staffing it with specialists. The professors and instructors from the Siberian Metallurgical Institute have accomplished a number of major projects which have won recognition at many enterprises. These projects include, for example, the use of a blast with a fixed moisture content; the introduction of highly basic sinter; the reduction of manganese content at every stage of metallurgical production; the intensification of smelting with compressed air; the heat treatment of rails; and many other projects. Therefore, the assistance of the Siberian Metallurgical Institute would be very useful to the new institute. Also it would be necessary to merge into a single establishment all the institutes, branches, and teams established in the Kuznetsk Basin. The "VostNIIGRI," the branch of the "VuKhIN", and the team from the "TsNIIChermet" [Central Scientific Research Institute of Nonferrous Metallurgy] as well as other organizations currently lack suitable premises and equipment and therefore cannot be very productive.

In return, the pedagogical Siberian Metallurgical Institute would gain much. After all, then the students could be broadly mobilized for laboratory research and acquire a good training for independent scientific work.

The idea of establishing such a large scientific research center has been expressed more than once. It is shared and supported by our metallurgists as well as by the Kemerovskiy Sovnarkhoz and the Party units in the Kuznetsk Basin. The State Committee of the Council of Ministers USSR on the Coordination of Scientific Research should consider this matter circumstantially. It is no longer possible to delay a decision on it. A definite amount of time is needed to organize, build, and equip the institute, whereas the conduct of extensive scientific research is already on the day's agenda.

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5. Ferrous Metallurgy in Soviet Central Asia

(Narodnoye Khozyaystvo Kazakhstana [National Economy of Kazakhstan],

Tashkent, No 10, Oct 1961, p 23)

...The development of the base of ferrous metallurgy in Soviet Central Asia is determined by the ever-increasing demand of this region for ferrous metals (pig iron, rolled stock, etc.).

It will be economically expedient not only to expand the existing Begovat Steelmaking Plant but also to organize the production of metal on the basis of the exploitation of the existing Cental Asian and South Kazakhstan deposits of iron and coking coals as well as on the basis of natural gas and low-cost electrical energy....

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6. Establishing the Country's Fourth Metallurgical Base

By S. Kolmakov

(Kommunist, Moscow, No 15, Oct 1961, pp 81-82)

The establishment of the material and technical base of communism requires a considerable expansion of metal output and hence also of iron ore extraction.

The draft of the Party Program provides for increasing steel output to 250 million tons annually by 1980. This will require the extraction of as much as 400 million tons of ore annually. This means that the current level of open-hearth production should be almost quadrupled, and ore extraction should be increased just about as much. Of great importance to solving this grandiose task is the utilization of the iron ore deposits of the Kursk Magnetic Anomaly (KMA).

The Kursk Magnetic Anomaly has long been known. As far back as 40 years ago V. I. Lenin foresaw that the future utilization of the natural wealth of the Anomaly will play a tremendous role in the development of ferrous metallurgy and in the establishment of a broadly developed material and technical base of communism. And having formed a special commission for the study of the KMA he expedited the organization of prospecting and exploratory activities there and enlisted many prominent scientists in the work on this problem.

Vladimir Il'ich wrote: "I wish to point out the exceptional importance of the work to explore the Kursk Magnetic Anomaly.... we have there unprecedented rich resources of pure iron...almost surely a treasure-trove unheard of in the world, which should revolutionize the whole busi-

ness of metallurgy." (Lenin's Collected Works," Vol 34, p 466). Further, in his letter addressed to G. M. Krizhanovskiy ("Works," Vol 35, p 472), V. I. Lenin pointed out to the Gosplan that "this matter should be handled in an especially energetic manner."

Soviet scientists, workers, engineers, and technicians have carried out extensive prospecting and exploring work in the region of the KMA. Under Soviet rule the area of the KMA has been broadly investigated at 600,000 different points. As a result, the proven reserves of iron ore increased hundreds of times as compared with the pre-Revolutionary era. A rich accumulation of ores in the KMA region was discovered on the territory of the Kurskaya, Belgorodskaya, Orlovskaya, Kaluzhskaya, Bryanskaya, Smolenskaya, Khar'kovskaya, and certain other oblasts. The KMA basin measures up to 200 kilometers in width, more than 700 kilometers in length, and 140,000 square kilometers in area. The deposits of the KMA contain more than 250 billion tons of iron ores. For comparison, let it be recalled that the total iron ore reserves of all regions of the United States at present are estimated at 75 billion tons.

Concerning the general developmental prospects of the KMA, Comrade N. S. Khrushchev in his report "Forty Years of the Great October Socialist Revolution" declared:

"In the regions of the Central USSR, which possess a broadly developed industry, wide prospects for further development in the future are opening up in connection with the development of gigantic reserves of iron ores of the Kursk Magnetic Anomaly. This, the largest iron ore basin in the Soviet Union, capable of providing the large metallurgical industry with sufficient high-grade iron ore for hundred of years, will undoubtedly play a major role in the further consolidation of the industrial might of the USSR."

The enormous iron ore reserves of the KMA as well as their high quality make it possible to build there not one but a whole series of metallurgical plants. This region occupies a convenient location relative to the plants of the Central and Southern European USSR. The construction in the region of the KMA of metallurgical plants will ease the work of transport considerably by relieving it of the conveyance of metal from the Southern USSR to the Central USSR.

The active utilization of the ore base of the KMA satisfies the aims of the complex utilization of natural resources. And this happens to be just the most important condition for expanding industrial might with the minimum expenditure of means and energy and, at the same time, for the conservation of our natural resources. The complex utilization of natural resources yields the maximum increase in labor productivity and opens the road for employing the optimal technological methods of de-

veloping mineral deposits. It is precisely in the combines based on the coordination of successive production stages and utilizing their raw materials comprehensively that we observe the most perfect expression of the Leninist principle of a sound geographical distribution of industry from the standpoint of proximity of the raw material base to all stages of processing of the semifinished product, ending with the obtaining of the final product itself.

In the light of the complex utilization of natural resources and combining of production processes, as envisaged in the draft of the Party Program, the importance of the Kursk--Donets-Basin Combine is exceptionally great. This combine can be established within a historically short period. The region of the KMA is endowed with the most favorable economic conditions for this purpose: proximity to the Donets Basin as well as to the industry of Moscow City and Moscow region. It is sufficient to mention that at the Ural--Kuznetsk-Basin Combine the regions of fuel extraction are separated from ore deposits by a distance of 1,500 to 2,000 kilometers, whereas here [KMA] in the case of combining Kursk ores with Donets fuel, the distance between the fuel and ore extraction regions is about 10 times shorter.

The construction of the Kursk--Donets-Basin Combine will serve as the beginning of the rise of the country's fourth metallurgical base, in the region of the Kursk Magnetic Anomaly. The KMA Basin has a convenient geographical location. It lies in the heart of the European USSR, and it has a broadly developed industry, a dense transport network, a highly mechanized agriculture, and skilled manpower cadres. In the KMA Basin there occur abundant resources of building materials: cement, brick, quarry-stone, and marl. All this makes it possible to commence now the preparations for building a metallurgical plant in the KMA Basin.

A separate discussion is merited by the construction of canals in the region of the KMA. These canals will open for Belgorod, Staroskol'skaya, and Kursk ore a new, extremely short water route to the ports of the Moscow, Black, Baltic, and White Seas. Side by side with the Belgorod and Kursk water development projects on the Seym and Northern Donets, it is possible to solve the Upper-Don problem -- the linking of the Don Water Basin to the Oka River.

A rise in the level of the waters of the Seym, Northern Donets, Upper Don, and other rivers, will make it possible to irrigate vast land tracts in the Kurskaya, Belgorodskaya, Voronezhskaya, and Orlovskaya oblasts as well as a number of Ukrainian oblasts. In addition, the formation of new water expanses in these areas will affect the local climate positively, assure high yields of cereal, industrial, and other crops, and make it possible to develop poultry raising and fishery on a broad scale.

The construction of the canals will result in a reduction in the influx of water to the rich ores of the Kursk Magnetic Anomaly, which will make it possible to perform open-strip extraction of the ores on a large scale. As is known, currently the bulk of the ore of the Kursk Magnetic Anomaly is mined underground. Open-strip mining is practiced only at the Levedinskiy and Mikhaylovskiy mines. In this connection, the further expansion of the open-strip method of ore mining entails great possibilities for increasing labor productivity, which in open-strip operations is four to five times higher than in underground mining.

Calculations show that in this basin, within the next 10 to 15 years, it will be economically expedient to organize the open-strip extraction of iron ores, on the scale of more than 60 million tons annually (inclusive of underground extraction the total annual extraction would then be about 100 million tons). This will serve to provide with ore the plants of the Central USSR, to create a reserve for the plants of the Southern USSR, and to build two or three new metallurgical combines of the type of the Kuznetsk Metallurgical Combine in the Kuznetsk Basin.

The construction of mines, metallurgical plants, housing, and social and cultural and communal facilities in the KMA Basin will involve a considerable volume of mining, electrical-installation, and construction operations. In view of this, the Academy of Sciences USSR as well as the planning agencies of the RSFSR should as soon as possible draft a long-range plan of complex utilization of the natural resources of the Kursk Magnetic Anomaly.

So that the problem of the Kursk Magnetic Anomaly may remain at the focus of the attention of Party, economic, scientific, and planning agencies, we suggest the following amendment to the draft of the Party Program:

"To consider it as a vital task to establish the country's fourth metallurgical base on the basis of the inexhaustible iron ore deposits of the Kursk Magnetic Anomaly.

"To expedite the development of the wealth of the Kursk Magnetic Anomaly, to commence within the next five years the construction of the Kursk--Donets-Basin Combine. To draft a long-range plan of complex utilization of the natural wealth of the Kursk Magnetic Anomaly."

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